The CRUSHED STONE JOURNAL

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- Board of Directors Will Meet at French Lick
- If Delivered Prices are Outlawed, Then What?
- Gains In Accident Prevention Made During 1935

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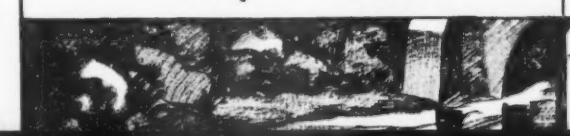

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The Bulking of Sand and Its Effect on Concrete

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Reprint of "Comparative Tests of Crushed Stone and Gravel Concrete in New Jersey" with Discussion

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Investigations in the Proportioning of Concrete for Highways

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The Effect of Transportation Methods and Costs on the Crushed Stone, Sand and Gravel, and Slag Industries

BULLETIN No. 9

Tests for the Traffic Durability of Bituminous Pavements

Single copies of the above bulletins are available upon request.

The Crushed Stone Journal

Official Publication of the NATIONAL CRUSHED STONE ASSOCIATION

J. R. BOYD, Editor

NATIONAL CRUSHED STONE ASSOCIATION

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The Pacific Highway near Bellingham, Washington. The State of Washington has for a number of years successfully used large size aggregate in concrete highway construction.

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Large Size Coarse Aggregate For Concrete Pavements and Bases

By A. T. GOLDBECK
Engineering Director
National Crushed Stone Association

◆ Highway departments have done a remarkably efficient job of constructing economical highways and now economy is more than ever the "watchword." The present article seems especially appropriate, for it suggests a possible method for effecting further economies and improvements in concrete bases and pavements.

WHAT follows lies partly in the realm of speculation and is the result of a very natural inquiry as to why large aggregates are not generally utilized in the construction of concrete pavements and bases. Can large aggregates be used for such construction and would their use be advantageous?

In the March, 1936, issue of *The Crushed Stone Journal* there appeared an excellent discussion of "The Use of Large Size Aggregates in Concrete" by T. C. Powers of the Portland Cement Association. Mr. Powers refers to concrete containing aggregate larger than 2 inches as mass concrete and for the sake of uniformity the same designation will be used here. He relates the accidental circumstances which led to the use of 8 inch maximum size instead of 3 inch maximum size aggregate in 1909 in the Panama Canal. As a result of this work, Mr. E. O. Keator, Engineer in Charge, reported that, "concrete made of the 8 inch aggregate dumped and flattened out to a thickness of 10 inches without any trouble," and that "the 8 inch material could just as well be used as the 3 inch."

A 10-inch slab approaches and in fact equals the thickness of many concrete bases and pavements and if it is possible to "flatten out" concrete made with 8 inch aggregate to a thickness of 10 inches, it doesn't seem unreasonable to believe that slabs of 6 inches might easily be built with aggregate of 4 inches maximum size.

Possible Advantage of Large Size Aggregate in Pavement Construction

(a) Effect on Cost of Concrete:

It is an established fact that mass concrete (concrete containing larger than 2 inch aggregate) is more economical than concrete having smaller aggregate because equal strength may be obtained in mass concrete with a lesser cement factor. This is so because the larger aggregate takes the place of approximately an equal volume of mortar. Evidence of the economy to be effected is presented in Fig. 1 from Powers' paper. Here it will be seen that, for concrete having a maximum size of 4 inches, 4.1 sacks of cement are required per cubic yard of concrete, as against 5 sacks per cubic yard when 1½ inch aggregate is used. This saving of 0.9 sacks is offset to some extent by the use of more coarse aggregate, for it will be observed that the weight per cubic foot of the 1½ inch aggregate concrete is 152 pounds as against about 155 pounds per cubic foot for the 4 inch aggregate concrete. Fig. 1 applies to mass concrete such as used for dam construction.

Proportions which are more nearly in line with those used in highway construction are shown in Fig. 2 which is based on quantities from Bulletin No. 9 of the Lewis Institute. Such figures, of course, are

approximate, for the gradation and characteristics of the fine and coarse aggregates will necessitate some variation in proportions, but they are exact enough to illustrate the principle that by using

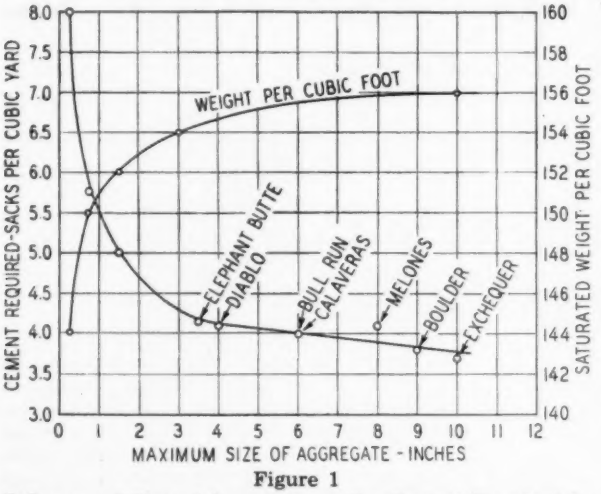

Figure 1

Influence of Size of Aggregate on the Cement Required to Produce 6.5 gal. per sack Concrete having a 3 to 5-in. slump.

large size aggregate a saving in cost of concrete will result. Using the quantities in Fig. 2 and assuming reasonable values for unit costs, let us see how the size of the coarse aggregate affects the cost of the concrete.

ASSUMED UNIT COSTS OF MATERIALS DELIVERED

Cement per bbl.	$2.50
Sand per cu. yd.	1.75
Coarse Aggregate per cu. yd.	2.00

Maximum Size of Aggregate = 1½ inch.

		Saving in Cost per Cu. Yd. over that for Concrete Containing Following Maximum Sizes of Aggregates.
Cement 1.45 bbl. at $2.50	= $3.62	
Sand 0.55 cu. yd. at $1.75	= 0.96	
Coarse Aggregate 0.75 cu. yd. at $2.00	= 1.50	
	$6.08	1½ in. 2 in.

Maximum Size of Aggregate = 2 inch

Cement 1.35 bbl. at $2.50	= $3.38	
Sand 0.48 cu. yd. at $1.75	= 0.84	
Coarse Aggregate 0.81 cu. yd. at $2.00	= 1.62	
	$5.84	$0.24

Maximum Size of Aggregate = 3 inch

Cement 1.28 bbl. at $2.50	= $3.20		
Sand 0.40 cu. yd. at $1.75	= 0.70		
Coarse Aggregate 0.85 cu. yd. at $2.00	= 1.70		
	$5.60	$0.48	$0.24

Maximum Size of Aggregate = 4 inch

Cement 1.25 bbl. at $2.50	= $3.12		
Sand 0.38 cu. yd. at $1.75	= 0.66		
Coarse Aggregate 0.87 cu. yd. at $2.00	= 1.74		
	$5.52	$0.56	$0.32

Let it be assumed that 2000 cubic yards of concrete will be required per mile of road, then if 4 inch maximum size aggregate is used, this would produce a saving in cost for concrete materials as compared with that for 1½ inch maximum size of 2000 cubic yards x $0.56 = $1120 and a saving of 2000 cubic yards x $0.48 or $960 when using a 3 inch as compared with a 1½ maximum size. The above quantities are calculated on the assumption that there can be 15 per cent of material larger than the nominal maximum size of aggregate. Thus a 1½ inch maximum size may have 15 per cent of material coarser than this and extending up to 2 inches.

These calculations do not take into account the possibility that the larger size of aggregate may be supplied at a lesser cost than the smaller sizes and should this be the case even greater savings would result.

Can Large Aggregate Concrete be Properly Placed and Finished?

It has been rather surprising to those who have handled large size aggregate concrete to observe how inconspicuous the larger fragments of aggregate be-

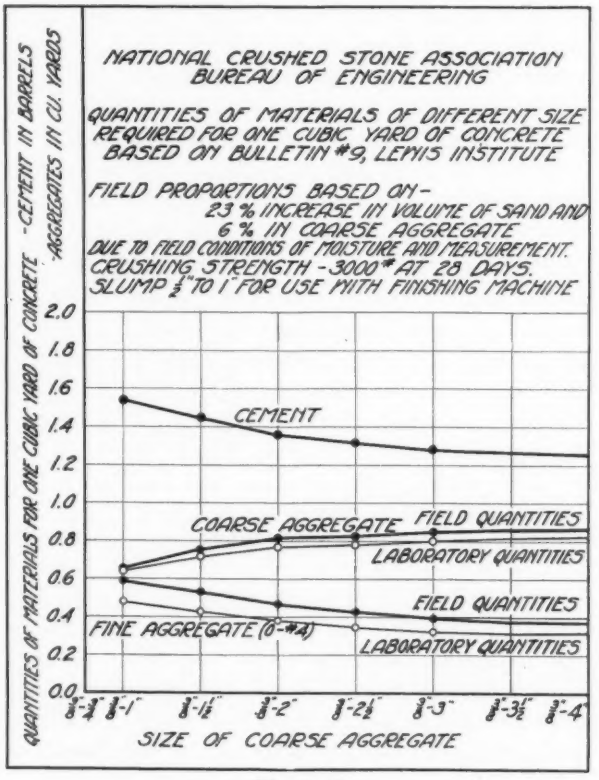
NATIONAL CRUSHED STONE ASSOCIATION
BUREAU OF ENGINEERING
QUANTITIES OF MATERIALS OF DIFFERENT SIZE REQUIRED FOR ONE CUBIC YARD OF CONCRETE BASED ON BULLETIN #9, LEWIS INSTITUTE
FIELD PROPORTIONS BASED ON -
23 % INCREASE IN VOLUME OF SAND AND
6 % IN COARSE AGGREGATE
DUE TO FIELD CONDITIONS OF MOISTURE AND MEASUREMENT.
CRUSHING STRENGTH - 3000# AT 28 DAYS.
SLUMP ½" TO 1" FOR USE WITH FINISHING MACHINE
QUANTITIES OF MATERIALS FOR ONE CUBIC YARD OF CONCRETE - CEMENT IN BARRELS - AGGREGATES IN CU. YARDS
CEMENT
COARSE AGGREGATE
FIELD QUANTITIES
LABORATORY QUANTITIES
FIELD QUANTITIES
FINE AGGREGATE (0-#4)
LABORATORY QUANTITIES
SIZE OF COARSE AGGREGATE

Figure 2

come in the concrete mass. Quoting from the paper by Powers previously mentioned, Mr. E. O. Keator's experience with large size aggregate in building the Gatun Lock evidently impressed him very favorably, for later, "he tells of using 3 to 5 inch maximum size in building construction, flat slabs and columns in 1913 at Portsmouth, Ohio, and 8 inch maximum size in spillway repairs at San Antonio in 1914. He states also that 6 inch crusher run was in use in the arches of the Florida East Coast Railway in 1914. Mr. Keator went so far as to advocate 6 inch stone or 7 inch gravel for 8 inch pavement."

In the State of Washington large size aggregate has been used in the past with success even before the days of machine finishing and before the use of vibration in finishing machines. Certainly, if large aggregate concrete could be finished by hand it should offer no difficulties in machine finishing.

Strength of Concrete

Theoretically, if the same quality of cement paste is used, there should be no particular differences in strength of concretes made with large as compared with small aggregates. Beam tests with large aggregate concrete cannot be made in the standard manner because of the inadequate dimensions of the standard beam unless the concrete is wet-screened to a smaller aggregate size and a correction factor is applied. Most tests comparing the various concretes have been made with compression specimens and there seems to be some uncertainty as to what the effect of the large aggregate is, for the tests are not in entire agreement.

Shrinkage of Concrete

In the absence of beam strength results made under truly comparable conditions, it may be interesting to call attention to a series of observations made by Mr. J. H. Walker and described by him in Paper No. 924 before the Institution of Engineers and Shipbuilders in Scotland. The paper was entitled, Concrete Roads, with Special Reference to Crack Control and Shrinkage Forces. Mr. Walker states, "It has been found by an examination of several massive dock walls, that those built of plain concrete develop wide vertical cracks from 40 to 80 feet apart, and those built with a large percentage of plums, or displacers laid close together do not develop visible cracks." Here is evidence that large size aggregate may be very beneficial in reducing cracking. As a result of his observations, Mr. Walker has developed a system of reinforcing consisting of steel hoops about 2 feet in diameter laid in the neutral plane of the road slab and he has stated that this method greatly reduces the visible cracks from forming. He explains their action by stating that shrinkage takes place around the hoops and leads to the formation of innumerable local but invisible cracks which take the place of large, visible, wide-open cracks. It is not unreasonable to expect that large size aggregate in roads will act in precisely the same manner in reducing cracking.

There is another point to consider also in studying the probable efficiency of large aggregate in reducing cracking. It is well known that Portland cement paste shrinks and swells with changing moisture content. The aggregates in comparison are practically unaffected by moisture changes. Consequently, it is reasonable to suppose that a decrease in cement content, such as is possible with large aggregate, will result in some reduction in shrinkage due to moisture changes and such shrinkage as occurs is quite apt to occur as local shrinkage around fragments of the large aggregate.

Advantage of Large Aggregate for Base Construction for Bituminous Pavements

It has been consistently maintained that for bituminous pavements it is extremely undesirable to have wide cracks formed in the base, for these are transmitted to the wearing surface, become sources of weakness and lead to high maintenance expense and unsightliness. For that reason a lean concrete base has been advocated by many bituminous paving engineers. On the other hand, others feel that a lean base has the disadvantage of lacking durability under frost and water action and, furthermore, has insufficient slab strength to support traffic loads.

Certainly, the ideal base for a bituminous surfacing is one which has low shrinkage and likewise high strength and durability and this ideal can be approached by the use of large aggregate concrete. Such a base would also have the further advantage of being cheaper in cost than one built with smaller aggregate. The advantages of large aggregate concrete for base construction have such high potential value that one is led to wonder why engineers do not take advantage of this rather simple possibility of obtaining not only cheaper but better concrete bases,

Suggested Gradation of Large Size Coarse Aggregates for Concrete Base

It is suggested that a suitable large size coarse aggregate for concrete base work, size No. 1234A, might be made from sizes, Nos. 12A and 34A given in the following table:

Size No.	Nominal Size Sq. Openings	Amount Finer than Each Sieve (Sq. Openings) 4"	3½"	2"	1½"	1"	½"	#4
12A	1"—3½"	100	90-100	25-60	...	0-15	....	....
34A	No. 4—1"	...	.....	.....	100	90-100	25-60	0-10
1234A (Combined Gradation)	No. 4—3½"	100	90-100	40-70	...	15-35	....	0- 5

The combined gradation, No. 1234A, may be produced by a combination of approximately 75 per cent of 1–3½ in. and 25 per cent of the No. 4–1 in. size.

It is suggested that the concrete made with this large aggregate be of a consistency which would have a slump of two to three inches when the slump test is made on that portion of the mix excluding material above the 1½ inch sieve. Further, it is suggested that the proportions be such as to produce concrete having a modulus of rupture at 28 days of 500 to 600 pounds per square inch.

While there seem to be outstanding reasons why large aggregate should give excellent results for concrete base construction, there also is reason to believe that equally good results will be obtained in concrete pavements. It is true that in pavements there might be some interference with reinforcing steel and dowel bars and that pocketing of the aggregate next to the joints and forms might cause some trouble. However, this possible trouble is purely speculative and by no means is it inevitable, if care is taken in the proportioning of the mix and if modern methods of finishing the concrete be used. It is felt that vibration next to the forms and the use of modern finishing equipment, whether of the vibrator or other type, would accomplish the finishing of a large aggregate concrete road slab in a very satisfactory manner.

For pavement construction, the same gradation as for bases should be suitable but the proportions should be such that the modulus of rupture will be from 800 to 900 pounds per square inch at 28 days. The beam test would have to be made on larger specimens than are now regularly used.

In conclusion it is believed that large aggregate concrete for concrete bases and pavements offers the strong possibility of effecting—

1. Considerable economy in cost of materials.
2. Decreased volume change and consequently fewer cracks.
3. Equally strong and durable concrete with a lesser cement factor than when smaller aggregate is used.

If the foregoing thoughts appeal to highway departments as having merit, why not give them a practical trial?

Highway Surveys to be Undertaken by 36 States

HIGHWAY planning surveys are now in progress or soon will begin in 36 states, according to the Bureau of Public Roads of the U. S. Department of Agriculture. The surveys are being conducted by the state highway departments with the cooperation of the Bureau. They will supply information to put future highway improvement on a sound, business-like basis.

In the past attention has been centered on improving the main through highways. In the future more attention must be given, highway officials say, to improving secondary and feeder roads and to improving conditions where the main highways pour their traffic into cities. At the same time the main highways must be maintained and further improved to meet needs that already exist, particularly as regards safety.

Federal highway officials who are coordinating the various state surveys think that a selection should be made of those roads that because of their importance merit early consideration in an improvement program. Future programs can be planned intelligently only with information as to which roads should be improved first. To determine this highway officials need definite facts as to traffic counts, construction costs, maintenance costs, how much taxes that can be fairly imposed for highway use, and where the taxes should be imposed from the viewpoint of highway usage.

Information along these lines is being collected in each of the state surveys. Each survey has three branches—a highway condition survey, a highway traffic survey, and a highway finance survey.

Highway transportation is now one of the major industries of the country. Its future development, says the bureau, should proceed according to a plan covering a period of years, and based on economic and social needs.

Some Phases of Accident Prevention[1]

By H. F. YOTTER

Insurance Supervisor and Safety Engineer
The General Crushed Stone Co., Easton, Pa.

◆ **The prevention of accidents in the operation of crushed stone plants should command the earnest and sympathetic attention of every producer in the industry. Mr. Yotter's observations in the following article reflect a comprehensive and practical understanding of the problem, gained from years of experience in safety work and we are confident you will find his discussion of real value.**

ACCIDENT prevention is primarily a matter of organization and education.

Existing dangerous conditions must be corrected and made safe before we can reasonably expect the cooperation of the employees in our efforts to reduce accidents.

Safeguarding has two functions—effect and appeal. It must not only prevent the accident which it is designed to avert but it must serve its purpose without unnecessary interference with the proper performance of the work. In other words, it must be practical. If not practical, it is useless and a hindrance, rather than a help, in preventing accidents. It must not unnecessarily interfere with a man's work if he is expected to use it.

Whenever practicable, it is advisable to enlist the aid of the man on the job in planning guards. If the workman feels that he has had an active part, even though minor, in the provision and design of a safeguard for his protection he takes a keener interest in its use. He comes to look upon it as *his* guard. Humans respond to nothing so completely as mutual confidence. Suggestions from workers as to safety should be encouraged. In this manner their interest will be increased and their initiative stimulated.

It is possible to nearly attain perfection in the matter of safety devices, but human frailty does not permit of perfect control of the human element. You can probably recall in your own work instances where men of long experience who were generally steady and conscientious, with good safety records, in a moment of thoughtlessness suffered injury thru taking ridiculous chances. To illustrate this point, we had an experience at one of our plants involving a man of more intelligence than is possessed by the average worker, who was assisting in rivetting a truck body. This man had been with us for some twenty years and up to the time of this incident had an excellent safety record. The dolly fell out of the rivetting hammer which was being operated by a fellow workman. The operator laid down the machine and walked away temporarily, when the helper, whose duty it was to heat the rivets, picked up the hammer and, out of curiosity, looked into it to ascertain whether the piston also had fallen out. In doing so he got against the trigger and promptly learned that the piston had not previously come out. Had he shut off the air at a valve located several feet away the injury would have been avoided; fortunately the result was not very serious.

Accidents due to this human failure, to a temporary lapse of a worker who is usually alert, are still with us and prove that our attention to unsafe practices and the faulty human element cannot be relaxed.

The employer is morally obligated to see that his employees are enlightened as to the hazards of their occupation and to make sure that they are alive and alert in their efforts to avoid accidents. Notwithstanding the efforts of management along these lines during past years, it is probably true that there are still many cases where accidents are caused due to the neglect of the employer to properly acquaint the workers with the dangers of their particular duties, and this lack of knowledge of risks on the part of the worker may even extend to some who have been in the same employ for a long while.

Management must lead the way and in a manner that the workers will be convinced of its sincerity. We must teach men to be alert in protecting themselves and those working near them. A workman who is wide awake and careful will not only achieve a good safety record but will also be equally concerned about the quality of his workmanship. An efficient worker is the safest worker. The right way to perform a task is the safe way.

In instructing our workers we must help them to develop mental capabilities that are stagnant from lack of use. We know that through disuse a muscle

[1] Presented at the annual meeting of the Quarry Section, National Safety Council, held on October 17, 1935, at the Kentucky Hotel, Louisville, Ky.

will shrink and atrophy, and the same application may be made to the mental equipment of men. The brain becomes strengthened by use, just the same as do muscles. We develop our lifting muscles by lifting and our thinking equipment by thinking. A prize fighter would not rise very high in his profession if he developed only his muscles and did not improve his thinking apparatus to a point where it will operate his muscles quickly and adroitly.

We are reminded of the warning given by an old lumberjack to his men—"Boys, when you hear the crack of the timber look out for yourselves, because when one of these big trees comes down you must be somewhere else, and be there quick. You must use your heads and use them fast." In our allied industries the failure of mechanical and human equipment is not usually preceded by as much warning as the cracking of timber before it falls, and our workmen must consequently foresee the dangers attendant on their work in order that they may avoid injury. We must appeal to the instinct of self-preservation and clearly point out the numerous hazards of our industry.

It is a known fact that the finger prints of no two humans are alike, and it is safe to consider that no two individuals are alike. This means that we are constantly called on to deal with different situations. There is no monotony in the work of accident prevention.

Safety is to get every man on the job to look his ground over in advance. In educating the workers it is highly desirable to teach and train them to be instinctively and habitually careful. Workers should become imbued with the safety habit. While this safety habit may not be so easy to acquire as are some others, it is infinitely more worth while. Getting men to think SAFETY and think it unconsciously is probably one of our most difficult tasks. The best safety device is a safe workman, and the safety device in a man's head is of greater value than the guard on the machine he is operating.

The best results in safety education are obtained by personal contact. Supervisors of safety who have many operating units under their direction do not have this personal contact with the rank and file to the same extent as do those who supervise only a few plants, and under these circumstances the duties of teaching the men how to avoid being injured devolve all the more heavily on the foremen in direct charge of the operation.

Accident prevention should be made the responsibility of the foremen, just as they are held accountable for quantity, quality and cost of production, as safety bears a close relation to each of these operating phases. When the foreman is convinced of the value of safety and is enthusiastic in preventing the men under his supervision from being hurt, considerable progress has been made in your program. By reason of his close contact with the men, the foreman is in position to notice the hazards of the work and determine the direct and indirect causes of accidents.

A careful study of working conditions, a thorough analysis of accidents occurring under them, and a searching inquiry into potential causes of accidents that have not yet occurred will give us an accurate picture of the hazards to which workmen are exposed and enable us to determine the proper means of forestalling or overcoming them. No remedy can be effective which is based upon a wrong diagnosis. It is manifestly of great importance that we profit by those accidents which do not involve injury to persons, as the difference between an accident without injury and one causing injury is sometimes only a matter of a fraction of a second or the fraction of an inch. These "narrow escapes" are well worth investigating.

If the foreman is an effective leader and holds the respect of the men, as is very necessary, he is placed in excellent position to influence his men to acquire the habit of working carefully and in such manner as will prevent their being hurt. If the foreman is held in high esteem by those in his charge, they will look up to him and the confidence thus established will simplify and facilitate his work of educating them to safe-mindedness. The foreman's efforts along this line are made easy if the men are convinced of his faith in the wisdom and value of accident prevention.

Safety engineering is really human engineering and the best results can only be attained if the foreman in charge can procure the sympathetic cooperation of every man at his plant or division of the operation. Thru the personal contact of the foreman with the workers they should be convinced of the necessity and value of cooperation, and only thru such whole-hearted cooperation can the maximum results in safety be obtained.

Foremen are seldom eye-witneses to injuries. It is therefore imperative that they should not fail to foresee an accident in the making. They too fre-

quently fail to see a workman doing something which their experience ought to tell them will, if repeated, result in an injury at some future time, and such an unsafe practice should be stopped before, not after, an injury occurs. Accidents do not happen, they are caused.

The average worker is inclined to pass his own judgment on matters affecting his safety, just as he is on other problems which confront him. He must therefore be properly and thoroughly educated in accident prevention so that his judgment will be sound. He must come to realize that hazards do exist in our industries, that he and his fellow workmen are exposed to them, and that it is highly important that he habitually exercise caution if he and his fellow workers are to avoid injury.

A workman must be safety conscious to the point where when he is confronted with a dangerous situation he will instantly recognize the risk involved and visualize the serious accident which is likely to follow if he takes the chance. Many men who have been free from accidents, or at least have escaped injury in such accidents as may have involved them, come to believe that they are immune from the injuries that befall others. This attitude is a very dangerous one and management must recognize that it has a serious problem in men with such convictions.

The human mind generally is not freely receptive to new thoughts suggested by others and this natural resistance must be overcome. When a new idea is broached to a man, particularly if it involves a change in his method of working, he challenges it in his own mind before accepting it as a fact. It is therefore necessary that the merit of the suggestion be made clear to him.

Accident prevention is an essential part and an inevitable result of good management. It is so closely linked with other problems of management that effective effort on one will likewise affect the other.

The lowered morale of employees due to reduced wages and the uncertainty of employment as the result of the decrease in business in our industries the past few years has caused them to be nervous and has taken their minds off their work. The problem of endeavoring to make ends meet on reduced income and other family troubles create a worry which follows the worker to his job and reduces his interest in the work he is doing and his alertness in doing it to an extent that it becomes a real accident hazard. Recent conditions of business in our industries have resulted in greater labor turnover thru some of the more experienced employees obtaining work of a steadier nature elsewhere, and any period of new hiring means at least a temporary increase in the accident rate.

In many instances this depression in business activities has resulted in a let-down in supervising. Foremen who usually did only supervisory work have been required to do work formerly done by the workers in an effort to reduce overhead. This method of endeavoring to cut overhead costs is questionable from an accident prevention point of view.

In this age of change, life is largely made up of new and varied ideas and tastes. We eagerly await the production of an automobile of new design and are ready to discard the old model for the new, even though the old one may still be quite serviceable. The frequent change of styles of wearing apparel persuades us to lay aside the old, but still useful, garments for those which are up-to-date, in order that our tastes may be gratified. Safety, fortunately, does not undergo these frequent changes; it is a great and simple truth and its worthiness and merit are its strongest appeal. It is based upon sane, clear and careful reasoning. I do not mean to imply that safety is not subject to advancement and progress; it is still open to improvement and is subject to more effective rules and regulations, but the fundamentals of accident prevention remain unchanged.

Safety bulletins play an important part in teaching accident prevention. Such bulletins, in order to be effective, must contain suggestions which cause the men to think about their own hazardous surroundings and enable them to apply the lesson of the poster to their own working conditions. Without this application to the conditions with which the men come in contact, the forcefulness and effectiveness of the bulletin is largely lost.

Since the last annual Safety Congress, the National Safety Council has issued 756 different safety posters. Insofar as possible, these posters have been designed to meet the need for bulletin board material and aimed at the outstanding common causes of accidents. We are advised by Mr. Stanley Kershaw, director of the Poster Division of the Council, that during the past twelve months the demand for these posters has reached the highest total figure in the history of the Council; over three million posters

(Continued on page 19)

Board of Directors Will Meet at French Lick Springs on July 23 and 24

THE mid-summer meeting of the Board of Directors of the National Crushed Stone Association will take place at the French Lick Springs Hotel, French Lick, Indiana, on Thursday and Friday, July 23 and 24, the meeting having been called by H. E. Rodes, Chairman of the Board, to convene at 4:00 P.M. on Thursday.

Though the mid-summer meeting of the Board has, since its inception, played an important part in the administrative affairs of the Association, this year a new significance attaches to this event in view of the fundamental changes made by the St. Louis Convention in regard to Association management and administration. It will be recalled briefly that in creating the offices of Engineering Director and Administrative Director the personnel in charge of these two departments was made directly responsible to the Board of Directors and not to the President of the Association, as was previously the case. It will therefore be recognized that as important as the mid-summer meeting of the Board has been in the past, an increased responsibility has been placed upon that body under the present set-up. It is therefore hoped and anticipated that a full attendance of the Board will be had at French Lick.

The decision to meet at French Lick was reached only after the most careful consideration and was prompted largely by the desire to hold the mid-summer Board meeting in a location more convenient to the midwest and southwestern sections of the country. It was also felt that the selection of French Lick would prove highly acceptable to the increasingly large number of Board members who desired to combine with the mid-summer business meeting an enjoyable week-end. Following the adjournment of the meeting on Friday, those in attendance should find ample opportunity amidst most pleasant surroundings for enjoying a wide variety of recreational facilities.

It has become a very happy custom in connection with the mid-summer meeting for Board members to bring their wives and at French Lick the ladies are sure to have a most pleasant visit.

Through special arrangements with the management the best rooms in the hotel will be available to members of the Board at substantially reduced rates.

In order to permit those within easy driving distance of French Lick to arrive in advance of the meeting, it has been called to convene at 4:00 o'clock on Thursday afternoon. Trains from the East arrive about noon and those from the West during the early afternoon, which will permit those travelling by rail to become comfortably settled before reporting to the meeting.

Reports covering the activities of the Association during the first six months of the year will be received from the Engineering Director and the Administrative Director. A detailed analysis of the financial condition of the Association will be submitted and a program of activities contemplated for the remainder of the year will be presented to the Board for its consideration and action.

In accord with past practice the meeting will consider the selection of the time and place for the next annual convention and also will give detailed thought to the type and character of convention which should be held in view of the action taken last March resulting in the dissolution of the Mineral Aggregates Institute. Consideration will also be given any other matters which may appropriately be brought before the Board.

A most cordial invitation is hereby extended to all members of the Association to be present at French Lick at the time of the Board meeting and it is especially hoped that those within convenient driving distance will take full advantage of this opportunity for participating in the governing affairs of the Association. You undoubtedly will find the meeting both interesting and profitable to say nothing of the recreational opportunities which can be enjoyed, over the subsequent week-end, at what is generally recognized as the "Carlsbad of America." If you can possibly do so, by all means arrange to attend. You will be assured of a most hearty welcome.

IMPORTANT ANNOUNCEMENT

SINCE going to press with this issue of the "Journal", the location of the mid-summer meeting of the Board of Directors, announced to take place at the French Lick Springs Hotel, French Lick, Indiana, on July 23 and 24, has been changed due to the extremely adverse weather conditions prevailing in the French Lick territory.

The meeting will now take place at the Homestead Hotel, Hot Springs, Virginia, on Friday, July 24, at 10:00 A.M., Eastern Standard Time.

The location of the Homestead, in the mountains of Virginia at an altitude of 2500 feet, gives assurance of favorable weather conditions for the meeting.

It is hoped that this change will cause no great inconvenience to those planning to attend.

If Delivered Prices Are Outlawed, Then What?[1]

By PHIL S. HANNA

Editor, Chicago Journal of Commerce
Chicago, Illinois

◆ **Though the Wheeler Anti-Basing Point Bill failed of enactment at the session of Congress just concluded, strong pressure may be anticipated in behalf of such legislation when the new Congress convenes next January. Much confusion apparently exists in the minds of Congressmen as to the full potentialities of Senator Wheeler's proposals. It would, therefore, seem highly desirable to utilize fully the opportunity now afforded between sessions to advise your congressional delegation as to the effect such legislation would have upon the conduct of your business. It is believed that the following article by Mr. Hanna should prove helpful in this regard.**

IT IS not only the steel and cement people who will be affected by legislation abolishing "basing point" systems but lumber, paper, petroleum, beverages, rubber, metals, sugar, flour and many others as well. It is even conceivable under a literal and strict enforcement of an anti-"delivered price" law that store keepers could not deliver goods to customers' homes without paying an extra charge.

Not many want competition abolished. In fact the various regulatory attempts indulged in by Congress to date have been with the idea of preventing monopoly and preserving competition. But before enacting new laws along this line it ought to be worth while to examine as to how elimination of delivered prices would work out in practice. This seems particularly important at this time because there are now pending in Congress four bills—the Patman Bill, H. R. 8442; the Wheeler Bill, S. 4055; the Borah-Van Nuys Bill S. 4171, and the Robinson Bill, S. 3154—which taken singly or in combination would, among other things, require goods to be sold at f. o. b. mill prices instead of at delivered prices. The Wheeler Bill states that the practice of selling goods at delivered prices "is carried on by a number of the leading industries of the United States, such as lumber, paper, petroleum, alcoholic beverages, rubber products, glass products, iron and steel products, fertilizer, metals, cement, sugar, and flour." Suppose delivered prices are outlawed! Then what?

FIGURE 1—Location of Cement Mills, Advantageous Freight Areas and Consumption in Illinois

It is easy to summarize the possible alternatives to delivered prices in one of the simplest of cases—the cement industry. Except for complications in industries where the products are more varied as to grade and size, the underlying principles are the same or similar to those cited for cement.

In the case of any product which is highly standardized, low in price and in which the cost of freight is necessarily an important item, the buyer is interested in the price at the point of use and will not pay a premium for any one brand over another of equal grade in the same market at the same time. With this in mind, let us examine the various possibilities of marketing cement.

Actually, as shown in Figure 1, the freight area in which any mill has an advantage is irregular, there may be one or more mills at a single location, and the prices at the mills may differ. These complications may be simplified and the principle brought out more easily as in Figure 2 on page 12, without changing the underlying features or results (except as to areas and amounts).

In addition, some mill, say mill C, Figure 2, may not be a basing point. But this would not change the relationship at market M and there would be no change in any of the examples cited in succeeding paragraphs. The only difference would be if point M were in territory C (Figure 2). Then M's relation-

[1] Reprinted from the *Chicago Journal of Commerce*, April 25, 1936.

ship to mill C would change, but not its relationship to mills A and B. Incidentally there are basing points at 116 of the 171 cement plants in the country. These plants have about 75 per cent of the country's total cement capacity. Less than 10 per

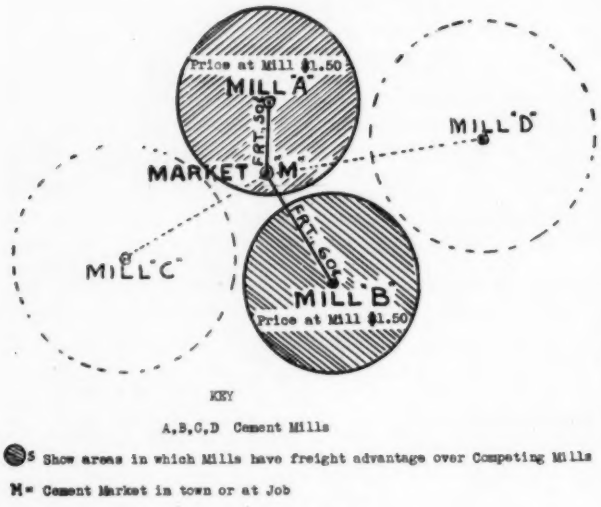

Figure 2
A Simplified Version of the Map in Figure 1

cent of the country's consumption is located more than fifty miles from a basing point. Therefore in considering mills A and B as basing points, we are considering conditions typical of 90 per cent of the cement industry.

For simplicity, then, assume, as shown in Figure 2, two cement mills, A and B, with basing points at A and B, competing in market M, with freight rates to M of 50 cents and 60 cents per barrel, and with prices at mill A and mill B equal, namely, $1.50 per barrel. Then

Price at market M = mill price, plus freight;
For A this would be $1.50 + $.50 = $2.00;
For B this would be $1.50 + $.60 = $2.10.

On this basis, there are seven different possibilities as shown by cases 1, 2, 3, 4, 5, 6 and 7 as follows:

Delivered Prices

Case 1—Buyers will not pay and so B cannot get a 10 cent premium for his product delivered at M. To compete, B can absorb his 10 cent disadvantage in delivered price at M and offer his cement not for $2.10, but to be competitive with A, for $2.10 – $.10 = $2. Thus B's price at M becomes equal to A's. By having *equal delivered prices* at M, mills A and B become competitive. However, A nets 10 cents less as he gets $2 (delivered price) minus 60 cents (freight) or $1.40; while B gets $2 – $.50 = $1.50. This is the so-called "delivered price" method . . . If this is not done, then let us consider–

Shrinkage by Railroad

Case 2—If B does not meet competition at M, he sacrifices the business. The railroad which has (or the several which have) been getting some business hauling from B to M would not be satisfied to forego this business. To retain it, the railroad could establish a rate from B to M that would put B's cement in market M at a price competitive with A's price when hauled from A to M. Under certain conditions the Interstate Commerce Commission can grant, and in many instances has granted, permission to charge a lower rate to a certain destination than is charged to intermediate points, but whether or not this permission is granted, the railroad itself can reduce its rate so long as the reduced rate is not unreasonably low.

Mill B, in order to retain or share in the business at M, and buyers at market M desiring more than one source of supply, also might petition the railroads and (or) the Commerce Commission for a lower rate (as has been done and as has been granted in many comparable cases).

This also compares with the well-established principle of equalizing the rates between two points. For example, the distance from X to Y may vary (and in instances has varied to 50 per cent or more) via two or more rail routes, but the rate via the longest (and all others) is the same as via the shortest. This makes the several routes competitive. The section of the interstate commerce law which permits a lower rate to a destination than applies to intermediate points, enables railroads to perform greater service at a less rate in one instance than in another instance, thereby meeting competition.

If cement is sold f. o. b. mill and if the railroads absorb the freight disadvantage, cross hauling still takes place. This subject, cross hauling, is discussed in a succeeding paragraph, I-c.

If railroads reduce rates in cases such as that from B to M to compete with shipments from A to M, they would neutralize B's 10 cent freight disadvantage and the result would be the same as case 1 ex-

cept that the burden of absorbing the price disadvantage would be shifted from the cement manufacturers, who now bear it, to the railroads. In other words, the interstate commerce law permits the railroads (when properly authorized) to do what cement manufacturers could not do if they were forced to adhere to f. o. b. mill prices. This arrives at the same net result—equal delivered price—as case 1.

Branch Plants

CASE 3—Mills suffering a disadvantage in their price by the time their cement reaches a market such as M (whether sold at delivered prices or f. o. b. mill) could establish branch plants such as distributing stations or warehouses, at market M where some manufacturing, packing and (or) shipping operations are performed. In fact, different cement manufacturers already have established branch plants at such points as Washington, D. C., Buffalo, Cleveland, Toledo, Detroit, Chicago, Milwaukee, Green Bay, Duluth, St. Louis, Memphis and other places. At some of these locations such as Buffalo, Duluth and St. Louis there are competing main plants, and at others there are not. Some of these branch plants are basing points and some are not. In any event, cement is shipped from these branch plants on the same basis as from a main plant. In short, if f. o. b. mill prices shut mill B out from market M, mill B can establish (as has been done) a branch plant at M (if it does not already have one) and thereby reach market M and surrounding territory just as if it had a mill at M. It similarly could (as has been done) establish a branch plant at A. This, then, gives the same net result—equal delivered price—as case 1 . . . If this is not done, then assume—

Shrinkage by Dealer

CASE 4—Then there is another alternative. A dealer preferring to buy from B (as he has, say for years) can absorb B's 10 cent higher price at M. Of course, a dealer would not pay a premium to B for the privilege (?) of handling B's cement. But assuming that the dealer would (in order to include this possibility, even if far-fetched), then the only difference with case 1 is that the burden of meeting the competitive price has been shifted from the manufacturer to the dealer. This arrives at the same net result—equal delivered price—as case 1 . . .

CASE 5—Next we have the alternative of shrinkage by contractor. The contractor can (if he will) pay a higher price at M (mill price plus freight) for B's cement than A's. In short, if the contractor wants B's cement (because, say, he has used it for years) and does not want to penalize his client for whom he is building, he, the contractor, in effect can absorb the 10 cents difference in the price of B's cement by the time it reaches M. Of course the contractor would not pay a 10 cent premium any more than would any other buyer. But assuming that he would in order to include this possibility, even if far-fetched, the net result then is the same as if mill B absorbed the price difference, which is the same net result—equal delivered price—as case 1 . . .

CASE 6—But we have not yet exhausted alternatives. F. o. b. mill with a variable mill price: A and B each can sell at f. o. b. mill prices (instead of delivered prices as in case 1). Then B, instead of absorbing his 10 cents disadvantage in delivered price at M (as in case 1), can shrink his mill price for cement to be delivered at M. Then B's new mill price (for cement going to market M) becomes $1.50 − $.10 = $1.40. His price by the time his cement reaches M then becomes $1.40 + $.60 (freight) = $2. This equals A's price when his cement reaches M. Except that the shrinkage is in the mill price instead of in the delivered price, this arrives at the same net result—equal delivered price—as in case 1.

Each of these cases—1, 2, 3, 4, 5 and 6—whether figured as a mill price plus freight or a delivered price at M, arrives at the same net result, namely, equal price by the time the cement reaches market M. If none of these methods or a combination of several of them is used, namely, a delivered price or a price figured on a variable mill base or their equivalents, then only one alternative remains, namely—

CASE 7—F. o. b. mill with a rigid mill price: Mills A and B can each have a rigid mill price—that is, the same mill price to all buyers,—instead of a variable mill price as in case 6. Then B will have a lower price and therefore a monopoly in all markets surrounding his mill (shown by the circle around B) that are closer freight-wise than A; and mill A similarly will have a monopoly at M and at all other markets (circle A) that are closer freight-wise than B (or any other mills).

If B wants to share in the business at M, he can reduce his price f. o. b. mill by 10 cents (not only for

deliveries to M as in case 6 but because this is a rigid mill base, then for all deliveries to all buyers). Then B's mill price becomes $1.50 – $.10 = $1.40. Since mill B will then have, for all deliveries, a lower mill price ($1.40) than mill A ($1.50), mill B can

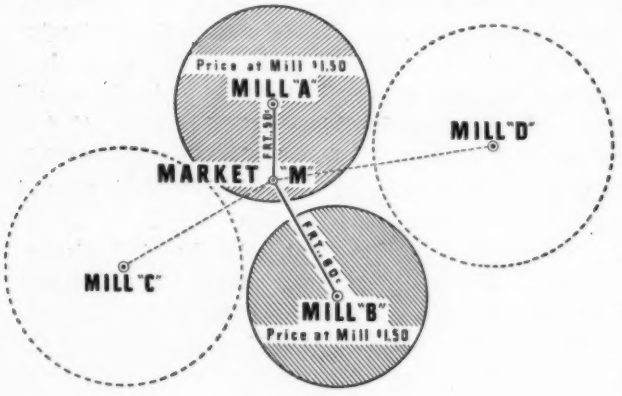

Figure 2
(Repeated for Reader's Convenience)

reach farther toward A than before. In short, all that happens in this case is that B increases the size of the territory (circle) around his mill (figure 2) in which he has a monopoly, and correspondingly reduces the size of the territory around A where A has a monopoly. In other words, A still has a monopoly and B still has a monopoly. If A then reduces his mill price by 10 cents, from $1.50 to $1.40, we are back where we started, with A and B having equal mill prices. Previously they were both $1.50; now they would both be $1.40, and we can again assume cases 1 to 7 and arrive where we now are.

The foregoing case 7 assumes a rigid mill price—or the same f. o. b. mill price for all sales. But it is evident from cases 2, 3, 4 and 5 that by either one of them or a combination of several of them, the disadvantage in price of B's cement by the time it reaches M will be absorbed either by one agency or another or several of them. And this is true whether cement is sold at delivered prices or at f. o. b. mill prices, and whether the mill price is a variable one or a rigid one. In short, by whatever method is used, cases 2, 3, 4, or 5, we arrive at the same net results as case 1—equal delivered prices or their equivalent.

The reason for this is that it results naturally from competition where two or more sellers (and two or more railroads or other agencies) compete to sell any buyer. If not by one method then by another, the seller or railroad or other agency or several of them, when handicapped by a price disadvantage on a highly standardized product, will seek some means to remove the handicap and put themselves in position to compete. This is not lack of competition but is evidence of competition even though it results in equal delivered prices or their equivalent.

Being a natural result, the question arises whether some forced artificial alternative will serve better.

However, to pursue this further, let us assume that none of the methods (cases 1 to 6) of absorbing the price disadvantage govern (a false assumption as shown above) and assume, simply for the sake of argument, that case 7, a rigid mill price, is, in fact, one alternative.

There are in effect, then, only two major alternatives:

ALTERNATIVE I—Variable mill price or its equivalent (resulting in equal delivered price or its equivalent). As has been shown, all of the possibilities, cases 1, 2, 3, 4, 5 and 6, arrive at the same net result, namely equal price at M. For convenience, these are therefore grouped as alternative I. Either the manufacturer, or the railroad, or the dealer, or the contractor absorbs the disadvantage in the price of B's cement by the time it reaches market M by absorbing B's 10 cent disadvantage in freight or its equivalent. This can be done by shrinking the delivered price (case 1); or the freight rate (case 2); or by a branch mill (case 3); or by shrinking the resale price (cases 4 and 5); or by shrinking the mill price (case 6); (or by some combination of two or more of these cases). In each case, 1, 2, 3, 4, 5 and 6, cement from either A or B becomes the same in price by the time it reaches market M. All of these are, in effect, variations of a variable mill price and all result in equal delivered price or its equivalent. The only alternative is:

ALTERNATIVE II—Rigid mill price—This is case 7. (It was shown that this would not be effective, but we are assuming, for the sake of argument, that it would be.) If it is effective, this results in a monopoly for mill A for a large or small area around mill A (depending upon whether A's price at his mill is the same, higher or lower than B's price at B's mill), and a monopoly for B for a large or small area around mill B. The same would be true for additional mills—C. D., etc.

Nothing with which man is concerned is perfect. There are evils of varying degree in business, in gov-

ernment, in education, in the family and in personal affairs. Likewise there are some imperfections or disadvantages to both I and II, to wit:

I. DISADVANTAGES: The chief disadvantage of alternative I (delivered prices or variable mill prices or their equivalent) may be stated as follows:

Price Shrinkage

I-a.—Mill B shrinks its price 10 cents to reach market M in circle A but does not shrink its price when selling within its own circle B. Apparently this penalizes buyers in circle B. But this is only apparent (except if mill A is not a basing point), because all buyers in circle B, whether they buy from A or B, pay the equivalent of B's mill price ($1.50) plus the least freight, namely from B; and all buyers in circle A (whether they buy from A or B) pay the equivalent of A's mill price ($1.50) plus the least freight, namely from A. In short, all buyers in circle A pay the lowest price, which is A's price plus A's freight, and all buyers in circle B pay the lowest price which is B's price plus B's freight. Also there is no discrimination, as all buyers in any given market (such as M) pay the same price. No buyer at M pays a higher price than some other buyer at M.

I-b.—But how about equal prices? Delivered prices are equal. This gives rise to the charge of lack of competition, which in turn suggests high prices. When prices are different, competition is supposedly evident. And when prices are the same, competition is supposedly not evident; but in practice in the case of delivered prices or their equivalent, competition none the less exists as is evident where B gets 10 cents less than A for cement delivered at equal prices at market M. In other words, with delivered prices, competition is not apparent at M because it has shifted from market M to mill A and mill B—in other words it has shifted from market to mill. That there is competition, and that it is real, and that it simply has shifted from market to mill is evident as herein shown, because even though A and B both sell at $2 delivered at M, they net different amounts, A getting $2 - $.50 (freight) = $1.50, and B getting $2 - $.60 (freight) = $1.40.

I-c.—Another misunderstood matter is *cross hauling*. Mill A ships into circle B, and mill B ships into circle A, that is they ship into each other's territories. This is called "cross hauling." It has been contended that if the excess costs of this cross hauling were eliminated, the savings could be passed on to cement buyers.

But cross hauling is not peculiar to industries that sell at delivered prices. Cross hauling applies to many products and industries not only from mill to market, but in wholesaling and retailing from city to city and within a city. For example, it applies in the deliveries of dairies, laundries, groceries, department stores and practically all others within a given trade area. A half dozen or more milk wagons pass one's house daily. This is cross hauling. But if they divided the city into zones, only one dairy would have to cover any one zone. But then there would be no competition.

Again, grocery A goes right past the door of grocery B and beyond to deliver potatoes—a stock commodity. Grocery B likewise delivers potatoes beyond the door of grocery A. This also is cross hauling. The same is true of practically all deliveries by all businesses. And the sum total of this cross hauling of all kinds of goods to millions of people in a single large city, say Chicago or New York, far exceeds the volume of cross hauling of the entire cement industry of the United States. One cannot have competition where two or more sellers are trying to sell potatoes or milk to the same buyer without the disadvantage of cross hauling. The alternative of cross hauling is monopoly.

In truth, however, the above is out of place, so far as cement is concerned, because the economic waste of cross hauling supposedly is due to selling cement at delivered prices whereas, as was shown in cases 2, 3, 4, 5 and 6, other agencies than the cement mill, such as the railroads, could absorb the price disadvantage if cement were sold f. o. b. mill and then there would still be cross hauling. In short, cross hauling is not peculiar to and as is not the result of selling at delivered prices. It is the natural result of competition, and takes place whether cement or milk or potatoes or a spool of thread is sold at delivered prices or at mill prices. Logic seems to say that the only alternative to cross hauling is monopoly.

Among the disadvantages of II—a rigid mill price, assuming, for the sake of argument, that such a method would be effective—are the following:

Monopoly

II-a. As has been shown (under case 7—rigid mill prices) any mill such as mill A has a monopoly in the territory surrounding its mill. Neither B (nor

any other mill) can sell in that territory at a price as low as A's. If B lowers its mill price so as to deliver at M at a price equal to or lower than A, then B simply *increases* the size of the circle (or territory) in which it has a monopoly and correspondingly *decreases* the size of, but does not eliminate the remaining territory in which A has a monopoly.

II-b. Buyers have no choice. Under II, cement buyers in any given territory have only one source of supply (except when two or more mills happen to reach the same point at equal prices). Thus buyers have no choice. They must buy from the one source (or pay a higher price to some other mill—that is, higher for the total of price at the mill plus transportation to the market or point of use). Monopoly under II is real.

II-c. And there is no flexibility. If construction declines because of drought, or closing of mines or removal of factories, etc., in any given territory, such as the area around mill A, then A cannot keep its mill busy because it cannot get business in outside territory such as B where B has a monopoly as it must have under II because of lower price). This is the natural result of a monopoly in II under an enforced rigid mill price.

II-d. As to monopoly on big jobs. If business booms in any territory, say territory B, because of real estate development, discovery of oil, or large construction projects such as a big road job, TVA construction Boulder Dam, etc., then mill B can charge abnormal prices (in a limited territory), and mill A and other mills cannot compete because B has a monopoly in that territory, as it must have in II with a rigid mill price. (If mill A comes into territory B we no longer have alternative II—rigid mill price and resulting monopoly—which we are discussing, but case 1, 2, 3, 4, 5 or 6 of alternative I.) By adhering to II, however, the monopoly is real.

II-e. What about the building of *new mills*? The middle of Death Valley may have an abundance of fuel and raw material for making cement, but one does not build a mill there because Death Valley affords no market. A market, as well as fuel and raw materials, is required to make and sell cement. Point C may be rich in fuel and raw materials and therefore one could make cement there at low cost and sell it at a low price. But if the territory around C affords no market, and if a mill built at C is prohibited from going into territory B (as it would be according to alternative II), no mill could be operated at C. Furthermore, buyers in B (and also A and other surrounding territory) would then fail to get the advantage of a new source of low-cost cement from point C. If, however, a mill at C could sell at so low a price that it could, on a rigid mill basis, reach into territory B, it would have a monopoly in part or all of B's territory. The advantage of lower prices that the consumer should get would be lost, because in one way or another alternative II—an enforced rigid mill price—results in a monopoly.

II-f. An assured monopoly is the final indication. Any other cases must reach the same net result because under II, an enforced rigid mill price results in a monopoly, if not for A, then for B or C for a large or small territory surrounding such mill. Under II, all mills (except where two are located at the same place or reach part of the same territory) will have monopolies around their mills.

If II—a rigid mill price—is not used we revert to I—a variable mill price.

As has been shown there are only seven cases (excluding combinations of one or more cases). Of these, case 7 is identical with alternative II—a rigid mill price—a monopoly around each mill; and cases 1, 2, 3, 4, 5 and 6 are variations of alternative I—a variable mill price or a delivered price or its equivalent.

The simplest, most equitable of these six variations is No. 1, a delivered price, which gives the buyer his cement in the terms he wants it, namely what it costs him at the place he wants it, and gives him the opportunity to buy it from one of several sellers at a price as low as that offered by the lowest.

Finally are advantages real or apparent? Alternative I has three main disadvantages (more apparent than real); and alternative II has six main disadvantages, all real. If these six disadvantages are deemed insufficient reasons for rejecting II, we should recall that the idea of II, a rigid mill price is, after all, a false assumption. It was assumed merely to study its presumed advantages and disadvantages, and thereby exhaust all possibilities. As shown by case 2 where the burden of absorbing the price disadvantage is shifted from the cement manufacturers to the railroads, a rigid mill price actually ends with the same net result as case 1, namely an equal delivered price.

This leads one to ask, why all the furor? Why try to impose something that accomplishes nothing? In

short, is any other price than a delivered price either desirable or possible with a standardized, low-cost product like cement? Should the delivered price system be abolished because it has some disadvantages? Writing also has disadvantages. It is used for improper communications, deceiving recipients, misleading people, forgery and other evils. Should writing be *abolished* because it is used for forgery? Is perfection attainable anywhere? If not, should alternative I, delivered prices or their equivalent, the most natural and least disadvantageous, be abolished because it has some imperfections, and be replaced by II, an artificial alternative that has more disadvantages and few compensating advantages and that will not provide any different net result?

If the various cases cited are correct, and if there is no other alternative (we know of none except some combination of the cases cited), it would seem that no matter what method is followed or forced, it arrives at the same net result as Case 1—equal delivered prices or their equivalent. In short, if manufacturers do not absorb the disadvantage in delivered price in any given market, someone else, most likely the railroads, will do so. The net result will be the same as Case 1, except that the burden of absorbing the disadvantage will be shifted from the manufacturers, who now bear it, to the railroads.

Delivered prices for a standardized, low-cost product like cement are the natural result of competition and of the preference of buyers. They are not interested in the price to them at the mill but in what cement costs them at the place of use such as market M. For this reason, any mill desiring to sell in market M must offer its product delivered at M (whether prices are quoted f. o. b. mill or at market M) at a price as low as the lowest offered by any other seller. In other words, competition forces all delivered prices or their equivalent down to the lowest and therefore equal to each other. This results in uniform delivered prices at M but in varying net prices received by the different mills such as A and B depending upon their distance freightwise from market M. As a result of delivered prices:

(x) The market price at M is as low as the lowest offered by any mill serving that market;

(y) Mills can ship to any markets they choose;

(z) Buyers in any market can buy from any of several mills serving that market at a price equal to the lowest offered by any such mill.

To conclude we would repeat that even though delivered prices in practice do contain some "evils" the practice has a mighty high batting average as things go in a country of free competition. Especially in view of previous efforts at legislation seeking to enforce competition, where monopoly has grown up despite the laws, it would seem prudent to stop, look and listen before erecting new barriers at a time when business recovery is sorely needed in the heavy goods industries.

Good Roads Pay Their Way

Through Reduced Operating Costs

HIGHWAYS pay their way by reducing the operating costs of vehicles using them, and on heavily traveled roads they return substantial profits to the public, says the Bureau of Public Roads after a study of the mileage of vehicle travel in three states in comparison with highway expenditures. Annual payments for highways, the bureau reports, amount to slightly more than one cent per mile of vehicle travel on all highways in Wisconsin, Michigan and Minnesota, according to figures collected by this bureau of the U. S. Department of Agriculture. In Wisconsin and Michigan the payment is 1.08 cents per mile and in Minnesota 1.1 cents per mile.

Analysis of highway costs and travel on the State systems, which include Federal-aid roads, of Wisconsin and Michigan shows that payments amount to .83 cents and .86 cents per mile of travel respectively. The figures for county roads are 1.23 cents in Wisconsin and 1.66 cents in Michigan.

The lower costs for main highways agree with the well established rule that large volumes of traffic make possible the construction and maintenance of high-type surfaces at a very low cost per mile of travel.

The actual saving in vehicle operating cost resulting from replacing a dirt road with a smooth, hard surface has been variously estimated and is probably not less than 3 cents a mile. On this basis, says the bureau, a large mileage of highways is paying tremendous profits to highway users. Actual payment of gasoline taxes and motor vehicle fees, when distributed in proportion to travel on different roads, show that many highways are earning substantial profits for the public.

Quarry Industry Makes Notable Gains in Accident Prevention During 1935

THE cement, mining and quarry industries all made creditable reductions in both frequency and severity of accidents during 1935, as compared with 1934, according to reports issued by the National Safety Council.

The reports in the cement industry cover the records of 119 plants whose employees worked 31,042,000 man-hours. The 1935 average frequency rate of 6.73 (the number of disabling injuries per million man-hours of exposure) is 5 per cent below the rate for 1934; and the severity rate of 2.78 (the number of days lost per thousand man-hours of exposure) is 32 per cent below the 1934 rate.

In the mining industry reports have been consolidated from 134 mines whose employees worked 54,978,000 man-hours. Their average frequency rate for 1935 is 49.46, which is 6 per cent below the 1934 rate; and their average severity rate is 10.14, which is 4 per cent under the rate for 1934.

Quarries made the biggest gains, these reports covering 119 operations whose employees worked 12,332,000 man-hours. The 1935 average frequency rate of 10.22 is 27 per cent below the rate for 1934; and the average severity rate of 1.72 is 53 per cent below the figure for 1934.

Comparing these accident experiences with similar rates assembled for all-industries, a further interesting story is told.

Cement plants had an average frequency rate of 6.73 in 1935 as compared with 14.02 for all-industries; and an average severity rate of 2.78 as compared with 1.78 for all-industries. The cement industry therefore ranks third in frequency and twenty-sixth in severity among all industries.

In the mining industry, its 1935 average frequency rate of 49.46 as compared with 14.02 for all-industries, and its severity rate of 10.14 as against 1.78 for all-industries, drop it to a rank of twenty-nine for frequency and to thirtieth for severity among all industries.

Quarries, however, with a 1935 average frequency rate of 10.22 as compared with 14.02 for all industries, and with an average severity rate of 1.72 as against 1.58 for all industries, now rank twelfth in point of frequency and twenty-first in severity among all industries.

Another interesting comparison is to be made among these three industries. In the cement industry all types of injuries have decreased in frequency and in severity since 1926, with the exception of permanent partial disabilities. This type of serious injury is up 51 per cent in frequency and 71 per cent in severity.

In mining operations, the frequency of disabling injuries has decreased 20 per cent since 1926, in comparison with an average reduction of 61 per cent for all-industries. Severity, however, is up 79 per cent, whereas for all-industries the rate has declined 43 per cent in the same period.

The chief types of compensable accidents in the mining and quarrying industries in 1935, according to state reports, were "falling objects" and "vehicles", which accounted for 49 per cent of all accidents.

The following table gives the percentage distribution, by type of accident, of the cases (nearly all compensable) covered in recent one-year reports from Illinois, New York, Maryland, New Jersey and Pennsylvania. These reports covered 224,661 injuries in all industries and 25,557 injuries in mining and quarry.

Type of Accident	Per cent in all Industries	Per cent in Mining and Quarrying
All types	100.0	100.0
Handling objects	25.9	17.6
Falls to a different level	8.7	2.5
Falls to the same level	9.5	5.7
Machinery	12.0	5.8
Vehicles	10.9	18.9
Using hand tools	7.6	8.8
Falling objects	8.7	29.6
Stepping on or striking against objects	5.6	4.1
Electricity, explosives, heat	3.6	2.7
Harmful substances	2.1	0.4
Other	5.4	3.9

In quarrying operations, the frequency of disabling injuries has decreased 68 per cent since 1926 in comparison with a reduction of 61 per cent for all-industries. In severity, the improvement is 91 per cent against an average improvement of 43 per cent for all-industries. The especially good 1935 records of quarries considerably improved the standing of the industry in comparison with other groups.

Some Phases of Accident Prevention

(Continued from page 9)

have been used during this period of a year, which is in excess of the demand for the year 1929, when the peak in volume of business was reached. Of the posters issued by the Council during the past year over seventy per cent were suitable for use by members of our Section.

'Twas a dangerous cliff, as they freely confessed,
Though to walk near its crest was so pleasant;
But over its terrible edge there had slipped
A duke and full many a peasant.
The people said something would have to be done
But their projects did not at all tally.
Some said, "Put a fence round the edge of the cliff",
Some, "An ambulance down in the valley".

The lament of the crowd was profound and was loud,
As their hearts overflowed with their pity;
But the cry for the ambulance carried the day
As it spread thru the neighboring city.
A collection was made to accumulate aid,
And the dwellers in highway and alley
Gave dollars or cents, *not* to furnish a fence,
But an ambulance down in the valley.

"For the cliff isn't bad if you're careful", they said;
"And if folks ever slip and are dropping,
It isn't the slipping that hurts them so much
As the shock down below—when they're stopping".
So for years (we have heard), as these mishaps occurred
Quick forth would the rescuers sally,
To pick up the victim who fell from the cliff,
With ambulance down in the valley.

Said one, in his plea, "It's a marvel to me
That you'd give so much greater attention
To repairing results than to curing the cause,
The thing that we need is PREVENTION.
For the mischief, of course, should be stopped at its source,
Come, neighbors and friends, let us rally;
It is far better sense to rely on a fence,
Than an ambulance down in the valley."

"He is wrong in his head", the majority said,
"He would end all our earnest endeavor.
He's a man who would shirk this responsible work,
But we will support it forever.
Aren't we picking up all just as fast as they fall,
And giving them care liberally?
A superfluous fence is of no consequence,
If the ambulance works in the valley."

The story looks queer as I've quoted it here,
But things oft occur that are stranger.
More humane, I assert, than to succor the hurt
Is the plan of removing the danger.
The preferable plan is to safeguard the man,
And attend to the thing rationally;
We should build up the fence and try to dispense
With ambulance out in the alley.

Approximately 60 per cent of PWA Funds Spent for Materials

WITH more than 95 per cent of the projects in the Public Works Administration's current construction program under way, tatisticians recently reported to Administrator Harold L. Ickes that nearly 60 per cent of the Public Works money spent thus far has gone for material manufacture which has blanketed the nation with indirect and industrial employment. This far exceeds the direct employment given on construction sites where the materials have been used.

A total of $1,331,500,000 was spent for materials up to June 1 these statisticians reported.

Practically all of this went for labor either in the mines, forests, the quarries and other places where the materials originated, in the factories where the raw products were fabricated and on the railroads on which they were transported to the sites. Such expenditures were a major factor in the steady revival of heavy industry where unemployment was greater than anywhere else during the depression.

Up to June 1, PWA statisticians reported that $678,832,000 had been spent for iron and steel products including machinery and transportation equipment for PWA projects.

Industries furnishing cement, brick, stone, glass, sand, gravel and similar materials for Public Works jobs received orders totaling $383,340,000 while more than $71,250,000 had been spent for lumber and forest products.

Statisticians estimated that at least 70 per cent of the $1,331,500,000 spent for materials up to June 1 went directly into the pockets of many hundreds of thousands of men employed in the mines, mills and factories in every section of the country, thus calling them back to jobs and restoring their purchasing power.

The expenditure for materials of $735,456,000 up to June 1, statisticians said, was nearly twice the amount paid in wages to men employed directly on construction sites.

It was reported that more than 68,000,000 man-months of labor had been furnished up to May 1 in completing 16,917 projects and in the construction of 5,367 additional projects.

The projects completed were estimated to cost $1,164,770,000 while the projects under construction are estimated to cost $2,331,885,000.

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